APPENDIX A
STORMWATER COMPOSITE SAMPLING SOP

STORMWATER SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting flow weighted composite stormwater samples from freshwater environments using a Teledyne/Isco (Isco) automatic sampler.

This SOP utilizes and augments some of the procedures outlined in the San Francisco Estuary Institute's Field Sampling Manual for the Regional Monitoring Program for Trace Substances (David et al. 2001), the Interagency Field Manual for the Collection of Water-Quality Data (USGS 2000), and U.S. Environmental Protection Agency (EPA) Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (EPA 1996). While some of these exact procedures are not used, because they are not necessary for this FSP, the clean techniques described in this guidance were used to assist in developing a series of procedures that will minimize the possibility of sample contamination. The goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by programs that follow these guidelines.

Though the above procedures are intended for sampling of trace metals, these procedures will provide a means to minimize the possibility of sample contamination in general for stormwater sampling of organic compounds as well as conventionals [such as total suspended solids (TSS), dissolved organic carbon (DOC), and total dissolved solids (TDS)].

SUMMARY OF METHOD

Flow-weighted composite samples of three storm events from each location will be collected to obtain Event Mean Concentrations (EMCs) of chemicals and conventionals. Flow-weighted, whole water (unfiltered) sample aliquots will be collected over the course of the storm event with automatic samplers. These whole water samples will be collected by the sampling teams, identified in Section 4 of the FSP, and transported to the LWG Field Laboratory. Samples will be collected from the sampler using two-person clean sampling techniques, similar in concept to the "clean hands – dirty hands" method (EPA 1996).

At the LWG Field Laboratory, sampler performance will be evaluated, and water from the individual samplers will be composited in a single container. Following sample compositing, sample bottles for individual chemicals will be filled using a peristaltic pump. Each sample will be analyzed for the chemicals shown in Tables 2-2 and 2-3 of the FSP.

Once the sample is collected and preserved (if applicable), the sample container will be capped, labeled, and placed on ice or refrigerated until shipped to the laboratory. Each field storage refrigeration unit will be monitored bi-weekly to ensure temperature compliance. Each unit will have a separate log form containing date, time, and

temperature information. Samples will be handled following the procedures described in the Chain of Custody SOP (Appendix F).

In general, any procedures not specifically detailed in this Appendix will be in conformance with the FSP, the QAPP Addendum (Integral 2007), and the Round 2 QAPP (Integral and Windward 2004).

SUPPLIES AND EQUIPMENT

The general types of equipment required are described in this section. A detailed supply and equipment list is provided in Table A-1. Additional equipment may be required depending on the sample site.

An Isco Model 6712 automated sampler unit will be deployed at each sampling location. The sampler will be equipped with glass collection vessels, a Teflon® screen, and a Teflon® sampling tube. Each sampler will be equipped with a cellular modem and area/velocity (AV) type flow meter. Power will be supplied to each sampler using a minimum 50-amp hour GSM deep cycle battery. In addition, stainless steel mounting brackets will be used to mount the flow sensor and sampling tube, and hang the battery and sampler in the catch basin.

Table A-1. Stormwater Sampling Equipment Required per Sampling Site

Equipment Item	**Number Required**
Isco 6712 Sampler	1
Sampler base to hold eight 1.8-liter collection vessels	1
Isco 1.8 liter collection vessels and Teflon® lined caps	24
Teflon®-coated stainless steel pick up screen	1
Teflon® intake tube	1
750 Flow module	1
Cell phone modem package	1
Remote power supply cable	1
12-volt 50-amp hour GSM deep cycle battery	1
Mounting hardware (varies by site) to secure flow probe and pick up screen.	1

Mounting hardware to Isco sampler and battery (varies by site)	1
Box nitrile gloves	1
Cooler with foam dividers	1

Additional equipment for the processing and filtering (as appropriate) of samples in the Field Laboratory are noted in the collection procedures sections below.

PROCEDURES

EQUIPMENT DECONTAMINATION

Each sampling team will be responsible for preparing their equipment prior to the sampling event. Sampling bottles and equipment will be decontaminated either by commercial laboratories noted in the FSP or decontaminated at the Field Laboratory by the field teams, as necessary. Commercial laboratories will follow their internal procedures for equipment decontamination, resulting in "certified clean" equipment to be used in the field. Equipment decontamination procedures are described below.

Teledyne Isco Glass Collection Vessels

- Wash with soapy water and rinse with tap water
- Rinse with reagent-grade acetone
- Rinse with 20% hydrochloric acid (HCl)
- Rinse three times with deionized (DI) water
- Replace in covered Teledyne Isco tubs.

Teflon® Suction Line

- Rinse twice with reagent-grade acetone
- Rinse thoroughly with hot tap water using a brush to remove particulate matter and surface film
- Rinse thoroughly three times with tap water
- Rinse with 20% hydrochloric acid (HCl)
- Rinse thoroughly three times with tap water
- Rinse thoroughly three times with DI water

- Rinse thoroughly with petroleum ether and dry by pulling air through the line
- If possible, dry overnight in a warm oven (use an oven temperature of lower than 150° F)
- Cap ends with aluminum foil.

Teledyne Isco Pump Tube

- Pump hot tap water through the tube for at least 2 minutes
- Rinse tube with 20% hydrochloric acid (HCl) for at least 2 minutes
- Rinse by pumping hot tap water through the tube for at least 2 minutes
- Rinse by pumping DI water through the tube for at least 2 minutes.

Teledyne Isco Sampler

The sampler top cover, center section, retaining ring, and tub of the automatic sampler will be cleaned with warm soapy water and rinsed with tap water. The two pump drain holes will be checked to see that they are open and free of debris or buildup.

During implementation of the FSP, it is not anticipated that screens and intakes tubes will be removed for cleaning between sampling events. The sampler will be programmed to purge the intake tubes several times before and after each stormwater sample is collected, which should ensure that any contamination from previous events is removed or sufficiently diluted to be unimportant. If upon routine inspection, it is observed that algae is growing in the intake tube, debris is blocking the tube, or any other gross contamination issues may exist, contaminated screens and intake tubes will be replaced with screens and intake tubes decontaminated using the methods described above. The silicon pump tubing will be decontaminated (using procedures noted above) or replaced with new decontaminated tubing after each sampling event.

Sampler Mounts and Other Equipment

Mounting equipment such as slip rings, nuts, bolts, and brackets will be washed with warm soapy water using a brush to remove any oil, grease or other residue from the manufacturing process. They will then be rinsed with reagent-grade acetone followed by DI water and allowed to dry. If available, a warm oven could be used to speed drying.

Installation of the brackets at the sampling sites may create debris that could become a contaminant source (i.e., drilling holes, using powder-actuated tools to set studs and/or welds). After the brackets have been installed, the work site will be scrubbed with a

brush to remove any debris and rinsed with DI water before the sampling hardware (intake screen) is mounted.

Coolers used to transport samples will be washed with warm soapy water using a brush to remove any residue and rinsed with tap water.

Sample Containers

Sample containers will be certified pre-cleaned containers obtained through the laboratory. Containers will be pre-cleaned according to laboratory SOPs and consistent with the Round 2 QAPP (Integral and Windward 2004) and QAPP Addendum (Integral 2007). Certification information will be kept at the laboratory and will be available for review at any time. The containers will be certified to the detection limits of this project per the FSP.

Phthalate-Free Procedures

For locations where phthalates will be sampled the procedures followed will be identical to those noted above with the following exceptions. During all decontamination procedures equipment will be handled with powder and phthalate-free vinyl gloves and will not be placed on any plastic or rubber surfaces (decontaminated stainless steel surfaces are preferred). Once decontaminated, Isco samplers will be placed in phthalate free containers before placing in coolers for transport.

Isco sampler tube and pumping connection systems will be checked for any plastic components that might come into contact with sample water and will be removed from the collection system to the extent practicable and/or replaced with either non-contact systems or alternative materials. Any potential sources of plastic or rubber contact that cannot be removed will be noted in the sampling report.

During field sampling procedures, bottles and any equipment potentially coming into contact with sample water will be handled with powder and phthalate-free vinyl gloves. Sample bottles will not be placed on any plastic or rubber surfaces during sample processing (decontaminated stainless steel surfaces are preferred). Once the sample bottles are filled after sample processing, they will be capped with Teflon® lids and placed in phthalate free containers before placing in coolers for transport.

STORMWATER SAMPLE COLLECTION

Clean Handling Techniques

The clean handling techniques are modeled after the “clean hands – dirty hands” method (EPA 1996) for collecting samples. It has been found that when working in the rain or other inclement weather and in confined spaces, it is not always possible to fully implement the EPA procedures. The clean/dirty hands technique requires two or more people working together. At the field site, one person is designated as "clean hands” (CH) and a second person as "dirty hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless gloves (including phthalate-free vinyl gloves for any locations where phthalates will be sampled) during the entire sampling operation and change gloves frequently, usually with each change in task.

CH takes care of all operations that involve equipment that comes into contact with the sample, and is responsible for the following:

- Handles the stormwater collection vessels (removes and replaces from Isco sampler)
- Handles collection vessels until they are placed and sealed into coolers
- Prepares a clean workspace in LWG Field Laboratory
- Sets the equipment (i.e., the sample bottles, filtration and preservation equipment) inside the laboratory

DH takes care of all operations that involve contact with potential sources of contamination, and is responsible for the following:

- Works exclusively exterior to the samplers
- Removes samplers from catch basins, if necessary, and releases catches and lifts off sampler cover for CH
- Replaces cover and latches sampler covers
- Handles the tools, such as hammers, wrenches, keys, and locks
- Handles the single or multi-parameter instruments for field measurements
- Sets up and calibrates the field measurement instruments
- Measures and records the water depths and field measurements
- Seals coolers.

Stormwater Sampling Procedures

Two people are needed to conduct the sampling, and a third person is responsible for sample logging and processing, and assisting with lifting the sampler in and out of the catch basin. In addition, the third person may be responsible for recording stormwater parameters.

When collecting the water samples from the Isco samplers, DH and assistant will remove the manhole or catch basin lid and CH will clear a work space and lay down a plastic sheet. DH will place the sampler on the plastic sheeting, release the catches on the sampler, and lift away the cover, thus standing it on the plastic sheeting. CH will inspect the inside of the sampler for signs of wear or debris. CH will then install Teflon®-lined caps on each of the collection vessels. CH will remove each collection vessel in turn, label it with a waterproof label, and place it a cooler with foam dividers. Phthalate samples will be placed in phthalate free containers prior to placement in coolers.

After the collection vessels have been removed from the Isco sampler, CH installs new "Certified Clean" collection vessels in the sampler. DH replaces the cover and catches. DH and assistant will place the Isco sampler in the catch basin and close and lock the lid, if applicable.

SAMPLE PROCESSING

Samples from the Isco sampler collection vessels are stored in sealed coolers with wet ice and transferred to the LWG Field Laboratory at the conclusion of the sampling event. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the collection vessels with clean non-contaminating gloves (including use of phthalate-free vinyl gloves for samples from any location requiring phthalate analyses), and transferring the collection vessels into clean refrigerators immediately after they are brought back from the field.

Storage Temperature Quality Control

Each storage refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

Sample Compositing and Processing

As part of the field sampling procedures, the sampling team will download the sampling report and flow data from the data logger, and review the data upon arrival at the LWG Field Laboratory. If the sampling report and flow data indicate that there was no

malfunction and all the sample bottles are intact, the sample compositing and preparation will continue as follows.

The contents of the Isco sampler collection vessels will be emptied into a large mixing container, decontaminated in the same manner as described previously for the Isco glass collection vessels and composited (i.e., using a churn splitter or other suitable apparatus). Samples for phthalate analyses will be mixed manually with a decontaminated stainless-steel rod held by a person wearing phthalate-free vinyl gloves. Following sample compositing in the mixing containers, composited water will be transferred to analytical sample bottles, with preservative if applicable, using a peristaltic pump (the pump tube will be decontaminated in the same manner as described previously for the Isco pump tube). The analytical sample bottles will be capped, labeled, and placed inside a cooler with foam dividers for transport to the analytical laboratory. Samples for phthalate analysis will be placed in phthalate free containers prior to placement in the cooler.

Whole water samples for organic compounds, and unfiltered/filtered water pairs for metals and TOC/DOC will be prepared by the sampling teams from the composite sample. Each sample will be analyzed for the chemicals shown in Tables 2-2 and 2-3 of the FSP. Filtered metals and DOC samples will be prepared by pumping composite water by means of a peristaltic pump (using the same clean tube as described above) through a 0.45-micron filter, dispensing directly into analytical sample bottles dedicated for filtered metals and DOC sample bottles. New decontaminated equipment for sample compositing and processing (i.e., mixing containers, pump tubing, and filters) will be used for samples collected from each location to prevent cross contamination between samples.

FIELD QUALITY CONTROL PROCEDURES

Field QC samples will be collected at the frequencies presented in the Section 3.8 of the FSP. The sampling program is designed to collect additional volume for field and laboratory QC samples at the following frequencies:

- Field duplicates - 1 per 20 samples
- Laboratory QC samples - 1 per 20 samples
- Field blank for all analyte groups – 1 per 20 samples
- Equipment rinsate blank for all analyte groups - prior to deployment of automated samplers.

The types of field QC sample collection are described below (USGS 2000).

Rinsate Blank. Prior to the start of sample collection activities for each sampling event, a rinsate blank will be generated by the laboratory that conducts decontamination of the sampling equipment to ensure that the decontamination procedure is adequate. To the extent that field decontamination procedures are necessary, some of the rinsate blanks collected will be of these field procedures so that the overall frequency noted above is attained. Per the FSP, the rinsate blank will be held open in the sampler so it is exposed to the same conditions as the sample bottles.

Field Duplicate. A field duplicate sample consists of aliquots of the same composited sample that are equally distributed in two sets of sample containers. These samples will be analyzed identically to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field Sampling Manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, CA.

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

Integral Consulting. 2007. Portland Harbor RI/FS Round 2 Quality Assurance Project Plan, Addendum 8: Round 3A Stormwater Sampling. Prepared for the Lower Willamette Group. Portland, Oregon.

Integral and Windward Environmental. 2004. Portland Harbor RI/FS Round 2 Quality Assurance Project Plan. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Mercer Island, WA.

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

APPENDIX B
STORMWATER GRAB SAMPLING SOP

STORMWATER SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting stormwater grab samples from freshwater environments using a Teledyne/Isco (Isco) automatic sampler in conjunction with a peristaltic pump and Teflon® tubing.

This SOP utilizes and augments some of the procedures outlined in the San Francisco Estuary Institute's Field Sampling Manual for the Regional Monitoring Program for Trace Substances (David et al. 2001), the Interagency Field Manual for the Collection of Water-Quality Data (USGS 2000), and U.S. Environmental Protection Agency (EPA) Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (EPA 1996). While some of these exact procedures are not used, because they are not necessary for this FSP, the clean techniques described in this guidance were used to assist in developing a series of procedures that will minimize the possibility of sample contamination. The goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by programs that follow these guidelines.

Though the above procedures are intended for sampling of trace metals, these procedures will provide a means to minimize the possibility of sample contamination in general for stormwater sampling of organic compounds as well as conventionals [such as total suspended solids (TSS), dissolved organic carbon (DOC), and total dissolved solids (TDS)].

SUMMARY OF METHOD

Stormwater grab samples for standard chemical and conventional analyses will be collected using a peristaltic pump that is part of the Isco automatic sampler. The Isco sampler will be removed from the sampling location by the sampling team. The sampler case will be opened and the delivery tube will be removed from the bulkhead fitting. A clean Teflon®-lined tube (using the procedures described in Appendix A for the Isco intake tube) will be connected to the bulkhead fitting to collect the desired samples. The sampler will be put into "Grab" mode and the specified volume will be programmed into the sampler. Once activated, the sampler will purge and the grab sample will be collected into four 1-gallon jars.

The sampling team will seal the 1-gallon sample jars with Teflon® lined caps, label, and package them as described in Appendix A for transportation to the LWG Field Laboratory. The sampling team will remove the grab sampling tube from the bulkhead fitting and reconnect the distribution tube and close up the sampler. The sampling team will re-deploy the sampler as described previously.

At the LWG Field Laboratory, the sampling team will combine the samples into a single composite for each event and samples will be filtered and prepared for laboratory analyses. The compositing, filtering, and sample preservation will occur at the Field

Laboratory as soon as possible after sample collection. The goal will be to conduct filtering within 24 hours of sample retrieval from the samplers. The samples shall be handled following the procedures described in the Chain of Custody SOP (Appendix F).

In general, any procedures not specifically detailed in this Appendix will be in conformance with the FSP, the QAPP Addendum (Integral 2007), and the Round 2 QAPP (Integral and Windward 2004).

SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. The grab samples will be collected with the peristaltic pumps built into the Isco sampler deployed at sampling site. Only sampling containers and a short length of Teflon® tubing will be required to collect the samples. Additionally, a cooler will be required to transport the samples to the LWG Field Laboratory. Additional equipment for the processing and filtering of samples is noted in the procedures and collection sections below.

PROCEDURES

EQUIPMENT DECONTAMINATION

Each sampling team will be responsible for preparing their equipment prior to the sampling event. The procedures described in Appendix A will be used to decontaminate sample tubing, mixing containers, and sampling jars; including special procedures for locations where phthalate sampling is required.

STORMWATER SAMPLE COLLECTION

Clean Handling Techniques

The clean handling techniques are modeled after the “clean hands – dirty hands” method (EPA 1996) for collecting samples. It has been found that when working in the rain or other inclement weather and in confined spaces, it is not always possible to fully implement the EPA procedures. The clean/dirty technique requires two or more people working together. At the field site, one person is designated as "clean-hands" (CH) and a second person as "dirty-hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless gloves (phthalate-free vinyl gloves for locations where phthalate

sampling is required) during the entire sampling operation and change gloves frequently, usually with each change in task.

CH takes care of all operations that involve equipment that comes into contact with the sample, and is responsible for the following:

- Handles the stormwater collection vessels (removes and replaces from Isco sampler)
- Handles collection vessels until they are placed and sealed into coolers
- Prepares a clean workspace in LWG Field Laboratory
- Sets the equipment (i.e., the sample bottles, filtration and preservation equipment) inside the laboratory

DH takes care of all operations that involve contact with potential sources of contamination, and is responsible for the following:

- Works exclusively exterior to the samplers
- Removes samplers from catch basins, if necessary, and releases catches and lifts off sampler cover for CH
- Replaces cover and latches sampler covers
- Handles the tools, such as hammers, wrenches, keys, and locks
- Handles the single or multi-parameter instruments for field measurements
- Sets up and calibrates the field measurement instruments
- Measures and records the water depths and field measurements
- Seals coolers.

Stormwater Sampling Procedures

Two people are needed to conduct the sampling, and a third person is responsible for sample logging and processing, and assisting with lifting the sampler in and out of the catch basin. In addition, the third person may be responsible for recording stormwater parameters.

The following procedures will be followed when collecting the water samples from the Isco samplers.

While the DH and assistant remove the manhole or catch basin lid, CH will clear a work space and lay down a plastic sheet. DH will place the sampler on the plastic sheeting, release the catches on the sampler, and lift away the cover, thus standing it on the plastic

sheeting. CH will inspect the inside of the sampler for signs of wear or debris. CH will then remove the distribution line form the bulkhead fitting and install a Teflon® line.

DH or assistant will re-glove to operate the Isco sampler. The program running on the Isco sampler will be interrupted and the sampler placed into "Grab" mode. DH will program the volume of water desired (1 gallon) and start the sampler. The sampler will purge the lines several times and pause before delivering the sample. The process will be repeated to collect the additional 3 gallons required for analysis.

CH will direct the flow of water into the sample containers. When complete, CH will then cap and label the sample bottle and place it a cooler with foam dividers. Once the samples have been properly secured, CH will remove the sampling tube and re-attach the distribution tube to the bulkhead fitting and return the sampler to standby mode.

DH will replace the cover and latch the fasteners. DH and assistant will replace the sampler in the catch basin and close and lock the lid, if applicable.

SAMPLE PROCESSING

All samples are stored in sealed coolers with wet ice and transferred to the LWG Field Laboratory at the conclusion of the sampling event. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the sample containers with clean gloves (and phthalate-free vinyl gloves in the case of phthalate samples), and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

Sample Compositing, Filtering, and Transfer to Sample Bottles for Laboratory Analysis

At the LWG Field Laboratory, the sampling team will combine the samples into a single composite for each event following the transfer and mixing procedures described in Appendix A. The compositing, filtering, and sample preservation will occur at the Field Laboratory as soon as possible after sample collection. The goal will be to conduct filtering within 24 hours of sample collection.

Filtering will be conduced using disposable 0.2-micron glass fiber filters. Clean Teflon® peristaltic tubing will be used to pump samples from the composite container through the filter, then through a similar outlet tube and directly into sample bottles. The glass fiber

filters and tubing will be replaced with clean equipment between sampling locations to prevent any cross contamination between locations. It is anticipated that Teflon® tubing will be decontaminated following procedures in Appendix A and then re-used for later locations or sampling events. Glass fiber filters will be discarded once they have been used.

FIELD QUALITY CONTROL PROCEDURES

Field QC samples will be collected during sampling following the frequency in the Section 3.8 of the FSP. The types field QC sample collection are the same as those for composite water sampling as described in Appendix A.

REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field Sampling Manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, CA.

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

Integral Consulting. 2007. Portland Harbor RI/FS Round 2 Quality Assurance Project Plan, Addendum 8: Round 3A Stormwater Sampling. Prepared for the Lower Willamette Group. Portland, Oregon.

Integral and Windward Environmental. 2004. Portland Harbor RI/FS Round 2 Quality Assurance Project Plan. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Mercer Island, WA.

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

APPENDIX C
SEDIMENT TRAP SAMPLING SOP

SEDIMENT SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting sediment samples from a catch basin using a sediment trap. A goal of this SOP is to ensure that the highest quality, most representative data be collected consistent with EPA guidelines.

SUMMARY OF METHOD

Sediment traps will be deployed at each location for a minimum target period of 3 months. Sediment traps will be inspected at a minimum on a monthly basis. When inspected, if the collection bottle is half full, sediments will be collected and archived and a clean bottle, filled with deionized water (to prevent floating) will be returned to the trap. This process will be repeated, and sampled sediments archived at the LWG Field Laboratory for additional later compositing until the trap deployment period ends.

Sediment samples will be capped with Teflon®-lined lids, labeled, sealed, and packaged appropriately for transport to the LWG Field Laboratory. At the field laboratory, the samples will be stored in the refrigerator.

Once the deployment period has ended, all sampled sediments (including archived aliquots) will be combined in one decontaminated stainless-steel bowl using decontaminated stainless-steel implements and thoroughly homogenized and subsampled in sample containers for chemical analysis.

In general, any procedures not specifically detailed in this Appendix will be in conformance with the FSP, the QAPP Addendum (Integral 2007), and the Round 2 QAPP (Integral and Windward 2004).

SUPPLIES AND EQUIPMENT

The equipment required for the sediment sampling includes:

- Sediment sampler constructed of stainless-steel and mounting hardware.
- 1-liter HDPE sample bottle with Teflon®-lined lid.
- Cooler with foam dividers for transporting samples.

Additional equipment may be required depending on the sampling location. Additional equipment for sample processing and homogenization are noted below in the procedures and collection sections.

PROCEDURES

EQUIPMENT DECONTAMINATION

Sediment Sampling Equipment Preparation

The sediment trap and mounting hardware will be constructed of stainless steel. Prior to installation, it will be cleaned using a scrub brush and lab-grade detergent, then rinsed in tap water, and allowed to dry. The sample bottles will be provided from the laboratory "Certified Clean" and filled with deionized water (sample bottles are filled with deionized water to prevent them from floating out of the sampler when there is water present in the catch basin).

The HDPE sediment trap bottles will be obtained certified clean from the laboratory and certified phthalate free.

When installing the brackets in the field at the sampling sites, it may be necessary to drill holes or use powder actuated tools to set studs, weld, or use other means to attach the sampling hardware that may create some debris that could become a contaminant source. After the studs are set or other procedures are complete, the work site will be scrubbed with a brush to remove any debris and rinsed with deionized water before the sampling hardware (sample bottle holder) is mounted.

Sediment Extraction and Compositing Equipment

The following equipment will be used to extract sediment from trap bottles and homogenize them for subsampling into sample containers: glass flask, stainless-steel implements (e.g., spoons), glass funnel, and stainless-steel mixing bowls. This equipment will be decontaminated as follows:

- Wash with soapy water and rinse with tap water
- Rinse with reagent-grade acetone
- Rinse with 20% hydrochloric acid (HCl)
- Rinse three times with DI water.

SEDMENT SAMPLE COLLECTION

Clean Handling Technique

The clean handling techniques are modeled after the "clean hands – dirty hands" method (EPA 1996) for collecting samples. It has been found that when working in the rain or other inclement weather and in confined spaces, it is not always possible to fully

implement the EPA procedures. The clean handling technique requires two or more people working together. At the field site, one person is designated as "clean-hands" (CH) and a second person as "dirty-hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless, and phthalate-free vinyl gloves during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes). CH takes care of all operations that involve equipment that comes into contact with the sample, including the following responsibilities:

- Handles the sediment sample bottle
- Prepares a clean workspace

DH takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Works exclusively exterior to the sampler
- Prepares the sampling equipment
- Handles the tools, such as hammers, wrenches, keys, and locks
- Measures and records the water depths and field measurements.

To control phthalate equipment contamination phthalate-free vinyl gloves will be used and all other equipment coming into contact with samples will be glass or stainless steel. No additional procedures to minimize phthalate contamination will be employed, because any trace amounts of contamination caused would be unlikely to be measurable in urban sediment samples.

Sediment Sampling Procedures

Two persons are needed to conduct the sampling. To set up the sediment collection system and process the samples, DH will remove the catch basin/manhole lid and the Isco sampler, if necessary, to provide access to the sediment trap. Using the confined space procedures in Appendix H, CH will double glove and enter the catch basin, if necessary, to retrieve the sediment sample. After entering the catch basin CH will discard the outer gloves and cap the sediment sample bottle with a Teflon®-lined cap. CH will remove the sample bottle. CH will pass the sediment sample to DH, who will pack it a cooler for transport.

DH will hand a new "Certified Clean" sample bottle (filled with deionized water) to CH. CH will place it the sampler and remove the cap. CH will exit the catch basin and DH and assistant shall redeploy the Isco sampler and reinstall the catch basin lid.

SAMPLE PROCESSING

All samples are stored in sealed coolers with wet ice and transferred to the LWG field laboratory at the conclusion of sampling. The field leader is responsible for maintaining sample integrity throughout the sampling event. Once at the field lab, sample contamination is avoided by handling the double-bagged sample containers with clean gloves and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

Storage Temperature Quality Control

Each storage freezer unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

Sample Compositing and Transfer to Sample Bottles for Laboratory Analysis

At the LWG field laboratory, the samples will be removed from the sediment trap bottles and transferred to wide-mouth jars for storage in the freezer until the end of the sampling period. Due to the holding times, the samples must be frozen. The Boston 1-liter sediment trap bottles are susceptible to breakage if frozen with the sample as collected from the field. Transferring the sample, although risking potential contamination, will allow much more reliable storage of the sediment sample by preventing breakage under freezing temperatures.

Sediment removal from the sample bottles will require several steps as the bottle opening is approximately 1/2 inch in diameter. The sampling technician will decant most of the water from each sample bottle into a decontaminated flask. The technician will then swirl or stir the remaining water with a decontaminated stainless-steel implement to mobilize the sediments. The technician will then pour the slurry into a decontaminated funnel with 2-5-micron filter paper and allow the leachate to drain to a decontaminated flask. Once the sediment has drained to a consistency allowing homogenization with a stainless-steel spoon, the sample can be lifted out by the filter material and placed into the decontaminated mixing bowl. The leachate water and the decanted water then can be used to rinse the sample bottle and remove the last of the sediments. Once the sample bottle have been emptied and the sediments have been added to the wide-mouth storage jar, a stainless-steel spoon can be used to scrape off any sediments that have adhered to the filter material into the wide-mouth storage jar. The leachate water or decanted water can be used to rinse the filter material. Note that water content of the sediment trap samples is not a critical parameter, because the sediment trap does not represent any ambient condition in terms of water content. Any water extracted from the trap or added back will be inconsequential to the objectives of this FSP.

Once the deployment period has ended, all sampled sediments (including archived aliquots, which have been allowed to thaw in the refrigerator) will be combined in one decontaminated stainless-steel bowl using decontaminated stainless-steel implements and thoroughly homogenized and subsampled in sample containers for chemical analysis.

Sample analysis containers will be filled in the priority order shown in Table 2-3 of the FSP, except for the alternate priority for some locations as described in Section 2.3 of the FSP, until the bowl is empty.

FIELD QUALITY CONTROL PROCEDURES

Field QC samples and frequencies are described in the FSP including:

- Field replicate, 1 per 20 samples
- Laboratory QC samples, 1 per 20 samples
- Equipment rinsate blank for phthalates, 1 per 20 samples.

The types of field QC sample collection are described below (USGS 2000).

Rinsate Blank. Prior to the start of sample collection activities for each sampling event, a rinsate blank will be generated by the laboratory that conducts decontamination of the peristaltic pump sampling equipment to ensure that the decontamination procedure is adequate. To the extent that field decontamination procedures are necessary (e.g., for homogenization and sample processing equipment), some of the rinsate blanks collected will be of these field procedures so that the overall frequency noted above is attained.

Field Replicate. A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

Per the FSP, field replicates will be generated by deploying sediment traps with additional sample collection vessels, and compositing the sediment from each half of the sediment trap collection vessels, separately, into two subsamples for analysis. Deployment of two vessels will only be possible at some of the locations, due to expected space limitations within the junctions. Consequently, after the location reconnaissance, the locations of the replicate trap deployment will be determined based on available space and other constraints noted above for sediment trap deployment. Replicate trap deployment will be conducted at sufficient locations to meet the 1 in 20 requirement. If this is not possible, the replicate analysis will be substituted with a replicate analysis consisting of homogenizing sediment from one vessel and splitting into two equal aliquots for analyses, at locations where sufficient volume is present, so that the 1 in 20 requirement. Analysis for laboratory QC samples will be conducted by dividing the total sediment collected from one sediment trap vessel at select locations with sufficient

volume into three aliquots of equal mass for the laboratory analysis of the sample, matrix spike, and matrix spike replicate.

REFERENCES

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

Integral Consulting. 2007. Portland Harbor RI/FS Round 2 Quality Assurance Project Plan, Addendum 8: Round 3A Stormwater Sampling. Prepared for the Lower Willamette Group. Portland, Oregon.

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USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

APPENDIX C-2
STORMWATER FILTERING FOR SEDIMENT COLLECTION (BACK UP PROCEDURE)

HIGH-VOLUME STORMWATER FILTERING

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of sediments in filter media from high-volume water samples. Samples are collected to quantify sediment concentrations of targeted organic chemicals (e.g., PCBs, and pesticides) that are present and that could not be collected with the preferred sampling methods.

A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

SUMMARY OF METHOD

Large volumes of water will be pumped through glass fiber filter cartridges, retaining particulates on the filters. A total volume of 1,000 liters will be pumped at each high-volume sample station at a flow rate of 2 liters per minute.

The water intake will be placed near the outlet of the catch basin with a long pole. Once the required volume for a particular analyte is established, the operator will run the pump at a fixed rate to collect a composite sample by setting the appropriate flow rate (i.e., 2 liters per minute) and then monitor the system during the time period necessary for sample collection. The operator will also monitor the in-line pressure and replace filters when necessary. Samples will be collected using the "clean hands– dirty hands" method. Once the desired volume is pumped, the column assembly will be removed and any residual water will be drained out. The glass fiber filters will be removed as needed and placed in appropriate containers, labeled, placed in a polyethylene bag, and stored in a cooler containing ice.

At the analytical laboratory, filters will be extracted and analyzed individually. Extraction of filters will follow the laboratory SOP as provided in the QAPP Addendum for Surfacewater Sampling (Integral 2004).

In general, any procedures not specifically detailed in this Appendix will be in conformance with the FSP, the QAPP Addendum (Integral 2007), and the Round 2 QAPP (Integral and Windward 2004).

SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. The equipment used for sediment sampling consists of a peristaltic pump and a sample tubing system composed of Teflon® tubing and Swageloc™ stainless-steel fittings. The filter unit is a high capacity spun glass fiber filter, 1 micron specified, manufactured by PALL Industries and pre-cleaned by Axys Laboratories. Other than the filters used for sampling

particulates, no containers are used for sample collection. Additional equipment may be required depending on site requirements. Filters for sampling particulates will be prepared in the laboratory.

For each sampling station, glass fiber filters from the laboratory are prepared. The sample intake requires a length of Teflon® tubing approximately 4-meters long. The nominal filter pore size used will be selected in consultation with EPA and its partners prior to mobilizing to the field sampling location. A portable 3000-watt power generator will be used if 120 VAC electricity is not available at the sample site to operate the pump.

PROCEDURES

EQUIPMENT PREPARATION

Before sample collection begins, the outside of sample containers and coolers are cleaned with a phosphate-free soap, rinsed with methanol, and finally rinsed with DI water. Sample containers are labeled with the date, sampling location, and a unique sample identification number using a permanent marker. Once cleaned and labeled, the sample containers are placed in coolers to keep from being contaminated during the sampling event. Date, site location, and sample identification numbers are noted on the field data sheet. A detailed site description with references to landmarks also is also provided.

Initial Setup

Prior to sampling, a clean Teflon® intake line is connected to an intake structure anchored in the stream of flow near the outlet of the catch basin. The discharge from the pump is discharged to the ground surface, down-gradient of the intake to prevent mixing of the waste water with the sampled water. The sampling unit can then be plugged into the generator for power.

Decontamination Procedures

Before sample collection begins, the sampler is completely cleaned and tested for leaks and other mechanical problems. The sampler is cleaned chemically after every sampling day. Clean phthalate-free vinyl gloves are worn during equipment decontamination. Once equipment has been cleaned, care should be taken to avoid touching or otherwise contaminating any surfaces that will come in contact with the sample water (e.g., inside surface of filter housings). Decontamination procedures are provided for the sampling unit, which also includes the filter housings and Teflon® coated O-rings, as well as tongs and forceps.

Sampling Unit Decontamination

Decontaminating the sampling unit includes not only the pump unit but also the filter housings and O-rings. Procedures for decontaminating each of these parts are provided below.

Filter Housings and O-rings

- Remove filter housings from unit
- Wash housings and O-rings using a scrub brush and a phosphate-free soap
- Rinse housings and O-rings with methanol
- Rinse housings and O-rings with deionized water. Use cleaned forceps to hold O-rings while rinsing.
- Allow cleaned items to air dry on aluminum foil. Place O-rings in filter housings, and re-connect housings to sampling unit.

Sampling Unit

- Plug unit in (generator or wall outlet) and power up the sampling unit using the main toggle switch.
- Check that the flow control valves on top of the unit both point in the same direction. The arrows on the valve handles point to the filter housing that water will be drawn through.
- With the intake line submerged in phosphate free soap, press the <ON> button on the control panel to start the pump.
- Increase the RPMs of the pump until the pump is primed and water is flowing through the unit.
- Draw 20 liters of soapy water through the system, followed by 5 liters of deionized water.
- Place the end of the intake line in a wash bottle with approximately 3 L of methanol. Continue pumping until all of the solvent has been drawn into the tubing.
- Following the acetone rinse, place the end of the intake line in a wash bottle with approximately 3 L of deionized water.
- Continue pumping until all of the water has been drawn through the tubing.
- Place the intake line into water to be sampled (effluent stream) to push the solvent and deionized water through the unit. Continue

pumping water for approximately 1 minute through the filter housing to thoroughly flush the system.

Tong and Forceps Decontamination

- Use a scrub brush with phosphate-free soap to thoroughly clean the tongs and forceps.
- Rinse with deionized water, then with a small amount of acetone.
- After cleaning, store the tongs and forceps in a clean storage container until needed. Once used, place the utensils in a separate container used only for contaminated items that need to be cleaned before use.

SAMPLE COLLECTION

Clean Handling Technique

The clean handling techniques are modeled after the “clean hands – dirty hands” method (EPA 1996) for collecting samples. It has been found that when working in the rain or other inclement weather and in confined spaces, it is not always possible to fully implement the EPA procedures. The clean handling technique requires two or more people working together. At the field site, one person is designated as "clean-hands” (CH) and a second person as "dirty-hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless, phthalate-free vinyl gloves during the entire sampling operation and change gloves frequently, usually with each change in task.

CH takes care of all operations that involve equipment that comes into contact with the sample, including the following responsibilities:

- Handles the glass fiber filters
- Handles the discharge end of the stormwater sample tube or line
- Prepares a clean workspace
- Sets the equipment (i.e., the filtration equipment)

DH takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Prepares and operates the sampling equipment, including the pumps and discrete samplers, peristaltic pump switch, and pump controller

- Handles the generator or other power supply for samplers
- Handles the tools, such as hammers, wrenches, keys, locks, and sample-flow manifolds
- Handles the single or multi-parameter instruments for field measurements.
- Sets up and checks the field-measurement instruments
- Measures and records the water depths and field measurements.

Stormwater Sampling Procedures

Two people are needed to conduct the sampling and a third person is responsible for sample logging and sample processing. Samples are collected using the clean handling techniques.

Step 1 – Insert Glass Fiber Filter.

- Unwrap pre-cleaned PALL glass fiber filter. Do not directly touch any exposed surfaces of the filter. If the exposed filter comes in contact with anything other than the interior of the filter housing, the filter is discarded, and a new filter is used
- Insert glass fiber filter into filter housing
- Once the filter is in place, reconnect the filter housing to the sampling unit and tighten housing with a wrench.

Step 2 – Reset Volume Meter

- Press <RESET> on the volume totalizer until the display reads 0.0.

Step 3 – Check Control Unit Settings

- Check the control unit to make sure the RPM light is on. If light is not on, press <STOP/RESET>
- Make sure the FORWARD direction light is on. If the REVERSE light is on, press the <FORWARD/REVERSE> button
- Make sure the PROGRAM light is NOT on. The pump will not operate in PROGRAM mode. If the PROGRAM light is on, press the <STOP/RESET> button
- Use the UP and DOWN arrows to control the RPMs. A good initial starting point is the target flow rate of 2 liters per minute.

Step 4 – Begin Pumping

- Press <ON> to begin pumping. It may be necessary to increase the RPMs to get the pump started. It takes a few moments to get water flowing through the entire system
- The moment that water is observed in the post-column line, reset the volume totalizer to 0.0. This is necessary to get an accurate volume measurement, because the totalizer will measure the water that was already in the lines from the cleaning process even though this water did not pass through the filter
- Adjust the RPMs until the flowmeter indicates that the unit is operating at the optimum pumping rate of 2 liters/minute
- Check all fittings to make sure there are no leaks
- Note on the field data sheet the start time, pumping rate, and initial pressure on the system.

Step 5 – Check System

- Check the sampling unit periodically (at least every hour) to ensure unit is operating correctly. Check and record the volume filtered, flow rate, and pressure
- If the pressure exceeds 15 psi, the glass fiber filter must be changed
- If the flow rate has decreased, increase the RPMs to maintain the optimum pumping rate of 2 liters/minute. If increasing the RPMs does not help, the glass fiber filter must be changed.

Step 6 – Complete Sample Collection

- Operate the sampling unit continuously until the desired volume of water has been filtered. For most in-stream samples, 1,000 liters of water are pumped through the system. However, smaller samples may be collected, depending on expected chemical concentrations
- Once desired volume has been filtered, cease pumping by pressing <STOP> on the control unit
- Record stop time and volume filtered on the data sheet
- Turn main switch on unit to off.

Changing the Glass Fiber Filter

The glass fiber filter must be changed if the pressure exceeds 15 psi, or if adjusting the RPMs does not increase the flow rate, by using the following procedure:

- Insert a glass fiber filter in the unused filter housing as described in Step 1
- Press <STOP/RESET> to temporarily cease pumping
- Record the stop time and volume filtered
- Switch both directional flow valves to point in the direction of the filter housing containing the clean filter
- Press <START> to resume pumping. See Sample Handling Procedures (below) to remove the used filter from the filter housing.

SAMPLE HANDLING PROCEDURES

The following procedures describe how the used filters must be handled once sampling is complete.

Glass Fiber Filters

- Remove the lower filter housing unit while being careful not to spill any of the particulate laden inside
- Use clean tongs to remove the used filter from the housing and place the filter in aluminum foil. Note that more than a single filter and jar may be required if the sampled water is turbid
- Label the aluminum foil wrapped filter with date and sample ID number
- Place container on ice in a cooler
- Record sample identification number on field data sheet.

SAMPLE PROCESSING

All samples are stored in sealed coolers with wet ice and transferred to the Field Laboratory at the conclusion of the sampling event. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the sample containers with clean gloves, and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

FIELD QUALITY CONTROL PROCEDURES

Field QC samples and frequencies described in the FSP for sediment trap samples will be used including:

- Field replicates, 1 per 20 samples
- Laboratory QC samples, 1 per 20 samples
- Equipment rinsate blanks, 1 per 20 samples.

Rinsate Blank. Prior to the start of sample collection activities for each sampling event, a rinsate blank will be generated by the laboratory that conducts decontamination of the pump and filtering equipment to ensure that the decontamination procedure is adequate. To the extent that field decontamination procedures are necessary (e.g., for homogenization and sample processing equipment), some of the rinsate blanks collected will be of these field procedures so that the overall frequency noted above is attained.

Field Replicate. A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field duplicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

REFERENCES

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

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Appendix D
Flow Measurements

FLOW MEASUREMENTS

The purpose of this standard operating procedure (SOP) is to describe the procedures for installation of the Isco Area/Velocity Flow modules. The goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

SUMMARY OF METHOD

Flow will be measured with the Teledyne/Isco 750 AV Module (module). The module is an add-on enhancement to the Teledyne/Isco's 6700 Series Samplers that are being used to collect stormwater samples. The module provides the ability to collect flow proportional sample volumes or flow-paced samples. The sampler displays the real-time level, velocity, flow rate, and total flow provided by the module. The sampler records this data for later analysis.

The module is designed to measure flow in open channels without a primary device (a primary device is a hydraulic structure, such as a weir or a flume, which modifies a channel so there is a known relationship between the liquid level and the flow rate). Area velocity flow conversion requires three measurements: water level, velocity, and pipe dimensions. The AV sensor provides the level and velocity measurements. The pipe dimensions will be measured in the field and entered during module programming. The flow calculation is made in two steps. First, the module calculates the pipe cross-section (or area) using the programmed pipe dimensions and the level measurement. Then, the module multiplies the channel cross-sectional area and the velocity measurement to calculate the flow rate.

The sampler will be programmed to use the customary U.S. units, such as feet (depth), cubic feet per second or gallons per minute (flow, depending on size of the contributing basin), and gallons or millions of gallons (volume, depending on the size of the contributing basin). The sampler will be programmed to record flow data at 5-minute intervals. These data will be periodically downloaded throughout the course of the sampler deployment (as determined by data storage capacity) and entered into the project database.

In addition, data on rainfall will be obtained from various existing established rain gauge stations around the Portland area. These data will be used to make sampling decisions throughout the course of the sampling and to understand flow results for data reporting.

SUPPLIES AND EQUIPMENT

The equipment consists of a flow meter module, a sensor and carrier bracket to attach the sensor to the outlet pipe.

PROCEDURES

EQUIPMENT PREPARATION

Mounting equipment such as slip rings, nuts and bolts, brackets will be washed with warm soap water using a brush to remove any oil, grease or other residue from the manufacturing process. They will then be rinsed with reagent-grade acetone and then with tap water and allowed to dry. If available, a warm oven could be used to speed drying.

Installation of the brackets at the sampling sites may create debris that could become a contaminant source (i.e., drilling holes, using powder-actuated tools to set studs and/or welds). After the brackets have been installed, the work site will be scrubbed with a brush to remove any debris and rinsed with DI water before the sampling hardware (intake screen) and AV sensor is mounted.

The sensor carrier bracket will be installed into the outlet pipe with an expandable ring so that the sensor will be located at the bottom of the pipe. The diameter of the pipe will be measured and noted for programming the Isco sampler. The flow meter sensor will be connected to the carrier and the cable will secured so that when the sampler is installed in the catch basin, the cable does not become kinked. The sampler will be turned on and allowed to self check. The installer will enter the programming mode and enter the diameter of the pipe. The installer will measure the depth of water in the pipe and adjust the sampler offset to match the measured value. The sampler will be prepared for the sampling team to install the clean sample bottles and deploy the sampler as described in Appendix A.

DATA COLLECTION

Data will be downloaded when water quality samples are collected. When the sampler is removed from the catch basin and the cover is removed a Rapid Transfer Module will be plugged in and data collected. The data will also be downloaded prior to disconnecting the power source when batteries must be changed. The data can also be downloaded via the cellular modem module. The data will not be erased and will be allowed to overwrite, in case there is a problem downloading the data (the sampler has adequate memory such that there should be capacity to store the entire data record for the sampling period).

Data will be downloaded from the Rapid Transfer Module at the LWG field laboratory and imported into a database using the Isco data management software.

Appendix E
Field Forms

Site Reconnaissance Form
Chain of Custody/Lab Analysis Request
Sediment checklist
Stormwater checklist

STORMWATER SAMPLING CHECKLIST

Date:			**Sampling Site:**		
Weather:			**Sampling Team Leader:**		
Prepare Field Equipment at LWG Field Laboratory Prior to Sampling					
Wash and Rinse Cooler	□		Fill Cooler with Ice		□
Latex Gloves	□		Plastic Sheet		□
Plastic Bags	□		Trash Bags		□
Replacement Sample Bottles	□				
Procedures at Field Sampling Site					
Inspect Outside of Sampler and Note Any Damage:					□
Prepare Sampling Site					□
Remove Sampler Cover					□
Record Displayed Flow Information	**Depth:**		**Flow:**	**Volume:**	□
Record Error Messages (if any, if none write "none"):					□
Cap Sample Bottles					□
Remove Sample Bottle					□
Label Sample Bottle					□
Bag Sample Bottle					□
Place Sample Bottle in Cooler for Transport to LWG Field Laboratory					□
Seal Cooler When All Samples Have Been Collected					□
Fill Out Chain of Custody Form (note time on form)					□
Plug in Rapid Download Module and Capture Data from Sampler					□
Check Battery Voltage and Record	**Volts:**				□
Notify O&M Team to Replace Battery if Below 12 Volts					□
Reset Sampler and Confirm Self Check (If self check fails notify O&M Team and Program Manager)					□
Install New Sample Bottles					□
Reinstall Sampler Cover					□
Redeploy Sampler					□
Call Sampler and Disable					□
Police Site and Put All Used Gloves, Bags, and Other Materials in Trash Bag					□
Procedures at LWG Field Laboratory					
Deliver Samples to the LWG Field Lab					□
With the Lab Technician Unpack the Samples Verifying that They are Properly Labeled and Not Damaged					□
Relinquish Custody of the Samples to the Laboratory Technician					□
Sign Chain-of-Custody Form					□
Have Laboratory Technician Sign Chain-of-Custody Form (note time on form)					□
Retain Carbon Copy with this Sampling Checklist					□
Notify Program Manager and O&M Team if Necessary					□

SEDIMENT SAMPLING CHECKLIST

Date:		**Sampling Site:**	
Weather:		**Sampling Team Leader:**	
Prepare Field Equipment at LWG Field Laboratory Prior to Sampling			
Wash and Rinse Cooler	☐	Fill Cooler with Ice	☐
Latex Gloves	☐	Plastic Sheet	☐
Plastic Bags	☐	Trash Bags	☐
Replacement Sample Bottle	☐		
Procedures at Field Sampling Site			
Inspect Outside of Sampler and Note Any Damage:	☐		
Prepare Sampling Site	☐		
Cap Sample Bottle	☐		
Remove Sample Bottle	☐		
Label Sample Bottle	☐		
Bag Sample Bottle	☐		
Place Sample Bottle in Cooler for Transport to LWG Field Laboratory	☐		
Fill Out Chain of Custody Form (note time on form)	☐		
Install New Sample Bottle	☐		
Police Site and Put All Used Gloves, Bags, and Other Materials in Trash Bag	☐		
Procedures at LWG Field Laboratory			
Deliver Samples to the LWG Field Lab	☐		
With the Lab Technician Unpack the Samples Verifying that They are Properly Labeled and Not Damaged	☐		
Relinquish Custody of the Samples to the Laboratory Technician	☐		
Sign Chain-of-Custody Form	☐		
Have Laboratory Technician Sign Chain-of-Custody Form (note time on form)	☐		
Retain Carbon Copy with this Sampling Checklist	☐		
Notify Program Manager and O&M Team if Necessary	☐		

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1423 3rd Avenue, Suite 300
Seattle, Washington 98101
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Outfall Recon Form – Lower Willamette Group

Outfall ID:	**Date:**	**Start Time:**
Elevation (NAD 83):	**Latitude:**	**Longitude:**
Site Access		
Security clearance:		
Traffic control:		
Site training:		
Site specific PPE:		
Outfall access		
Lid diameter:		
Depth to invert of basin:		
Inlet & outlet basin:		
Confined space:		
Sediment trap location:		
Iskco sampler location:		
Cellular reception:		
Comments & Drawings:		
Recorded by:		

Chain of Custody Record & Laboratory Analysis Request

Page ___ of ___ Turnaround Requested: _____

Anchor Contact: _____

ANCHOR ENVIRONMENTAL, L.L.C.
6650 SW Redwood Lane, Suite 110
Portland, Oregon 97224
Ph: (503)670-1108 Fax: (503)670-1128

Lab Contact:	Proj. Name:	Analyses Requested	Notes/ Comments:
Lab:	Proj. Number:		
Address:	Sampler:		
Phone:	Shipping Method:		
Fax:	AirBill:		

Sample ID	Sample Date	Sample Time	Sample Martix	# Con-tainers										

Relinquished: (Signature)	Relinquished: (Signature)	Relinquished: (Signature)	Special Instructions/Notes	
Printed Name:	Printed Name:	Printed Name:		
Company:	Company:	Company:		
Date/Time:	Date/Time:	Date/Time:		
Received By:	Received By:	Received By:		
Printed Name:	Printed Name:	Printed Name:		
Company:	Company:	Company:	# of Coolers:	Cooler Temp(s):
Date/Time:	Date/Time:	Date/Time:	COC Seals Intact?	Bottles Intact?

Appendix F
Chain of Custody SOP

CHAIN OF CUSTODY

The sampling team leader or other designated field sample custodian is responsible for all sample tracking and chain-of-custody procedures until sample custody is transferred to the laboratory.

Custody procedures in the field are as follows:

- Record all field and sample collection activities (including sample identification number, collection time and date) in the field logbook. While being used in the field, the logbook remains with the field team at all times. Upon completion of the sampling effort, the logbook should be reproduced and then kept in a secure area.
- Complete a chain-of-custody form whenever samples are being transferred or removed from the custody of field sampling personnel. A sample form is provided in Appendix E. Record each individual sample on the form. Include additional information to assist in sample tracking such as collection date and time, number of containers, and sample matrix. The chain-of-custody may also serve as the sample analysis request form, with the required analysis indicated for each individual sample.
- Sign the form and ensure that the samples are not left unattended unless secured.
- Store, pack, or ship samples as described in the appropriate SOP. Place the original completed chain-of-custody form in a sealed plastic bag inside the shipping container. A copy is retained by the shipping party.
- Complete a separate custody form for each individual shipping container or a single form for all samples in multiple shipping containers in a single shipment, with the number of containers noted on the custody form.
- Attach completed custody seals to any shipping container that will be sent to the laboratory by delivery service or courier. Delivery personnel are not required to sign the custody form if custody seals are used. Custody seals are used to detect unauthorized tampering with the samples. Gummed paper or tape should be used so that the seal must be broken when the container is opened. The laboratory sample custodian (or other sample recipient) will establish the integrity of the seals.
- The laboratory custodian (or other sample recipient) acknowledges receipt of the samples by signing, dating, and noting the time of transfer on the chain-of-custody form. The condition of the samples and any problems or irregularities (e.g., cracked or broken bottles,

loose caps, evidence of tampering) should also be recorded. Return a copy of the completed custody form to the project manger or designated sample coordinator.

The laboratory will designate a sample custodian who is responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed on transfer of the samples. Specific laboratory chain-of-custody procedures should be in writing, included in the laboratory QA plan, and approved prior to beginning sampling and analysis. Laboratory custody procedures should include the following:

- A designated laboratory person initiates and maintains a sample tracking log that will follow each sample through all stages of laboratory processing and analysis.
- The laboratory tracking log includes, at a minimum, the sample number, location and type of storage, date and time of each removal, and signature of the person removing or returning the sample.
- The final disposition of the sample is recorded.

Complete and correct chain-of-custody is essential to ensure and demonstrate sample integrity. Errors in entering information or transferring custody can result in analytical or data reporting errors. Inaccuracies or errors in sample tracking and custody records can compromise data usability, particularly as legal evidence.

Quality control procedures include the following:

- Allow adequate time to take accurate and complete field records and to carefully complete chain-of-custody forms.
- When possible, work in pairs or more to complete the chain-of-custody form and check for accurate information entry.
- Complete all custody records in ink; errors should be neatly crossed out and corrected and initialed by the person making the change.
- Immediately notify the project manager of any deviation from required custody procedures.

Environmental samples are packed in a manner to reduce the chance of sample breakage, ensure sample integrity, and prevent material leakage and potential exposure to hazardous materials in the event of breakage. Samples are packed in a sturdy container with adequate packing material to prevent breakage. Ice is included to maintain sample storage conditions. Samples are transported by field personnel or shipped via courier or

common carrier. Shipping procedures are in accordance with U.S. Department of Transportation regulations (49 CFR 173.6 and 49 CFR 173.24).

All preserved samples should be shipped as soon as possible after completion of sampling. This minimizes the number of people handling samples and protects sample quality and security.

Upon completion of final sample inventory by the field sample custodian and completion of chain-of-custody, samples are packed as follows:

- Use a leak-proof, sturdy cooler that can withstand rough treatment during shipping. The cooler's drain should be securely plugged and sealed with duct tape.
- Place the sample bottles tightly inside the in the shipping container:
- Fill any empty space in the shipping cooler or box with packing material so that the jars are held securely.
- Place the original completed chain-of-custody form in a sealed plastic bag and place it inside the shipping container. The form should be securely taped to the inside of the cooler's lid.
- If required to meet sample storage requirements, fill the cooler with wet ice or blue ice packs. A temperature blank (provided by the laboratory) should be packed in each cooler.
- Seal shipping containers securely with packing or duct tape.
- If the shipping containers will be transported by anyone other than the person who completed and signed the chain-of-custody form, attach completed custody seals so that the shipping containers cannot be opened without breaking the seal.
- A Fragile label may also be attached to reduce rough handling of the samples.
- Label the shipping container with all appropriate information (name of project, time and date, responsible person and company name, address and phone) to enable positive identification.

Packed containers may be delivered to the laboratory or storage facility by field personnel, courier, or common carrier (FedEx, UPS). However, any outside carrier or courier service must provide a delivery receipt. The carrier or courier must also ensure delivery time, if holding time and storage conditions are critical. Unless arranged in advance, shipping charges should be prepaid by sender to avoid confusion and possible rejection of the package by the laboratory.

The adequacy of handling and shipping procedures is reflected in the condition of the samples upon receipt by the laboratory:

- No jars containing water samples, sediment samples, or filters are cracked or broken.
- There is no evidence of sample leakage.
- Measuring the temperature of the temperature black indicates that correct storage conditions have been maintained.

The sample custodian or other designated person is responsible for confirming that copies of all shipping documents completed in full and correctly are on file.

Appendix G
Confined Space Health and Safety Plan Addendum

Anchor Environmental L.L.C., has officially accepted the Integral Round 2 health and safety plan (acceptance letter on June 18, 2004); Anchor intends to continue to use it for general health and safety measures. The following sections provide supplemental details of confined space entry policy and procedures.

ANCHOR ENVIRONMENTAL, L.L.C.

CONFINED SPACE ENTRY – OREGON POLICY & PROCEDURES

I. OBJECTIVE

To establish safe standard operating procedures for Anchor employees who engage in Confined Space Entry* work (Non-Permit or Permit). Entering a Confined Space* presents numerous occupational risks/hazards, therefore every precaution shall be taken. Anchor is committed to a safe and healthy workplace and will provide the necessary resources to protect its employees.

A. USING THIS DOCUMENT

This document contains technical information with very specific language. The important terms have been placed in the Definitions Section and marked with an asterisk (*) throughout the document. Each person reading this Policy is responsible for reading these definitions as well as the document itself.

II. POLICY STATEMENT

It shall be the policy of Anchor that all Confined Space Entry work be approved by a management representative and/or designee, and that all entries into Permit Required Confined Spaces (PRCS) be assessed and authorized by the Entry Supervisor*

It is every Anchor employee's responsibility to perform work in a safe and thoughtful manner.

Failure to comply with this policy could result in injury, illness or death. Additionally, non-compliance with this policy is a violation of OAR 437, Division 2/J, Permit-Required Confined Spaces (1910.146), which could result in regulatory fines by OR-OSHA.

III. SCOPE

This policy contains the necessary procedures and precautions to protect Anchor employees from hazards while working in Permit Required Confined Spaces and Non-Permit Confined Spaces. Any unusual confined entry or circumstance not covered under the procedural guidelines shall be discussed with the Anchor Health and Safety Manager (HSM) (see Responsibility Section) before work begins.

IV. TRAINING

Under no circumstances shall Anchor employees be allowed to work in Confined Spaces, until they have been *sufficiently trained* as an Authorized Entrant*, Attendant* and Entry

Supervisor*. Anchor shall certify that each employee who works in Confined Spaces has the essential knowledge, skills and abilities to identify, evaluate and control Confined Space hazards.

Sufficient training shall include a curriculum that reviews OR-OSHA Standards and Regulations, and identification of hazards typically encountered in confined spaces: physical; atmospheric; and abatement techniques; in addition to a basic knowledge of monitoring instruments, shall be included. A portion of the required training shall include "hands-on" instruction when actual entries are performed / observed by participants.

V. STANDARDS AND REGULATIONS

1. OAR 437, Division 2/J

2. OR OSHA 1910.146 Permit Required Confined Space

VI. DEFINITIONS

Attendant - an individual stationed outside a permit space who monitors the authorized entrant(s) and who performs all attendant's duties assigned in Anchor's permit space program. An entry attendant can also serve as a supervisor.

Authorized Entrant - an employee who is authorized by Anchor to enter a permit space.

Confined Space – A space that is large enough and so configured that an employee can bodily enter and perform assigned work; and

- Has limited or restricted means for entry or exit (example: tanks, sewers, wells, pipelines, vaults and pits)

- Is not designed for continuous employee occupancy.

Emergency – Any occurrence (including any failure of hazard control or monitoring equipment) of event internal or external to the permit space that could endanger entrants.

Engulfment – The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling the respiratory system or that can exert enough force on the body to cause death by suffocation, constriction or drowning.

Entry - The action by which a person passes through an opening into a permit-required confined space. Entry includes work activities in that space and is considered to have occurred as soon as *any* part of the entrant's body breaks the plane of the opening into the space.

Entry Permit – The written or printed document that is provided by the employer to allow controlled entry into a permit space

Entry Supervisor - The person responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required.

Note: An entry supervisor may also serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required, for each role he or she fills. Also, duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Hazardous Atmosphere – An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is escape unaided from a permit space), injury, or acute illness.

Hot Work – The employer's written authorization to perform operations (for example riveting, welding, cutting, burning and heating) capable of providing a source of ignition.

Immediately Dangerous to Life or Health (IDLH) – Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse effects or that would interfere with an individual's ability to escape unaided from a permit space.

Inerting – The displacement of the atmosphere in a permit space by noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible. Note – This procedure produces an IDLH oxygen-deficient atmosphere.

Isolation – The process by which a permit space is removed from service and completely protected against release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, piping or ducts; a double lock and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

LEL - lower explosive level.

Line Breaking – The intentional opening of a pipe, line or a duct that is or has been carrying flammable, corrosive or toxic material, an inert gas, or any fluid at a volume, pressure or temperature capable of causing injury.

Non-Permit Confined Space – A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Outside Personnel – Any persons working at the proposed sites, including, but not limited to employees of vendors, contractors, and of other LWG members.

Oxygen deficient atmosphere – An atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen enriched atmosphere - An atmosphere containing more than 23.5 percent oxygen by volume.

Permit Required Confined Space – (permit space) A confined space that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere;

2. Contains a material that has the potential for engulfing an entrant;

3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

4. Contains any other recognized serious safety or health hazard.

Permit Required Confined Space Program - The employer's overall program for controlling and where appropriate, protecting employees from permit space hazards, and for regulating employee entry into permit spaces.

Permit System – The employer's written procedure for preparing and issuing permits for entry and for returning permit space to service following entry.

Prohibited condition – Any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue Service – The personnel or outside agency designated to rescue employees from permit spaces.

Retrieval system – The equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

Testing – The means by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

Note: testing enables employers both to devise and implement adequate control measures for the protection of entrants.

VII. RESPONSIBILITIES

A. SENIOR MANAGEMENT (PARTNERS and GROUP MANAGERS)

1. Provide commitment, leadership, staffing and financial resources necessary to enable adherence to the requirements of this policy.

2. Establish performance criteria holding Middle Managers accountable for the compliance of this policy.

3. Continue to promote and reinforce individual responsibility and accountability as it relates to Occupational Safety and Health.

B. ANCHOR HEALTH AND SAFETY MANAGER

1. Ensure that all personnel who perform Confined Space Entry work are educated as to the contents of this policy.

2. Ensure that all employees, including those newly-assigned to work in confined spaces, (Entrants, Attendants and Entry Supervisors) are adequately trained and certified to perform Confined Space Entry work, and that training records are properly maintained according to Anchor policy.

3. Ensure that proper pre-entry protocols are completed prior to entry and maintained during entry. A designated employee (Entry Supervisor) may be assigned the responsibility of seeing that all Confined Space Entries are made in compliance with Anchor policies and procedures.

4. Ensure that Confined Space Entry equipment and personal protective equipment (PPE) are included in budgetary planning.

5. Ensure all appropriate safety equipment is available and used during Confined Space Entries.

6. Ensure that affected employees and their authorized representatives are consulted on the development and implementation of all aspects of Confined Space Entry Policy and Procedure.

7. Establish communication procedures to inform employees and employee representatives of pre-entry air monitoring results, certification of safe entry, and any hazard identified while working in Confined Spaces (e.g., atmospheric alarm).

8. Coordinate the activities of Contractors/outside personnel who will be working in or near PRCS spaces.

9. Review the effectiveness of this policy and procedure annually, using the cancelled permits to evaluate the confined space work done throughout the year, and revise the program to correct deficiencies if necessary.

C. FIELD TEAM LEADERS

1. Field team leaders shall ensure that the necessary resources are available to address provisions for compliance with the approved confined space procedures.

Note: All Confined Spaces are to be considered Permit-Required until the Entry Supervisor has researched and verified the historical data to down-grade the PRCS to Non-Permit.

2. Coordinate the activities of Contractors and/or outside personnel who will be working in or near PRCS spaces and ensure their compliance with OAR 437 Division 2/J, Permit-Required Confined Spaces (1910.146). Complete authorization form (Attachment A) of this document. After the Authorization Form has been completed and reviewed with the Contractor, the Project Manager and/or designee shall:

   a.) Give a copy to the outside personnel

   b.) Give a copy to the Entry Supervisor

   c.) File a copy in the Project file.

Note: No entry shall occur until the Entry Authorization form has been completed.

3. Inform the outside personnel* that the work they are performing requires entry into a Confined Space and that they are responsible for the safety and health of their employees and must comply with OAR 437 Division 2/J, Permit-Required Confined Spaces (1910.146).

4. Inform the outside personnel of any hazards Anchor has identified and past experience with that particular space:

Note: Authorization Form (Attachment A) can be used as a guide for Potential Hazard and the Safety Precaution/Personal Safety.

5. Inform the outside personnel of any precautions or procedures that Anchor has taken to protect its employees.

6. Coordinate entry operations with the outside personnel if Anchor employees will also be entering the space. When an entry is made by both Anchor and contract employees working together, procedures must be documented and the Anchor Health and Safety Manager notified.

7. Debrief the outside personnel to determine if any problems were encountered requiring a change in procedure.

8. Review outside personnel's work periodically and issue a stop work order if safety procedures are not followed.

D. OUTSIDE PERSONNEL

Outside Personnel\Contractors Shall

1. In addition to complying with permit space requirements, all outside personnel shall:

    a.) Obtain all information regarding confined space hazards and entry operations from Anchor's HSM; and

    b.) If Anchor employees are entering the same confined space then the Contractor shall coordinate entry operations with those employees.

    c.) Employers of outside personnel shall provide all equipment necessary to comply with safety standards.

    d.) Employers of outside personnel shall be responsible for all training of their employees.

Note: Additionally, the prime contractor shall coordinate entries of contractor's vendors and/or sub-contractors.

2. The contractor shall submit their procedures for entering confined space to Anchor's HSM for approval.

E. ENTRY PERSONNEL AND STAFF

1. All Personnel

    a.) Shall have a trained person as their attendant.

    b.) Shall follow the appropriate Confined Space Entry Procedures (confined space & Non-Permit) and ensure that equipment is used properly.

    c.) Be held responsible and accountable for personal safety.

2. Entrant(s) Duties (Permit space only)

    a.) Knows the hazards that may be faced (e.g., possible LEL conditions) during entry, including information on the mode, signs or symptoms, and consequences that might occur due to lack of oxygen or exposure to toxic air contaminants.

    b.) roperly use of all safety equipment provided for the job.

c.) Communicates frequently with Attendant to enable Attendant to monitor Entrant(s) status.

d.) Alerts Attendant immediately when a hazardous condition or problem develops, or when leaving the space.

e.) Exits the space immediately if ordered to by the Attendant, or if a prohibited condition or hazardous situation develops (e.g., atmospheric alarm).

3. Entrants Shall: (Non-Permit)

a.) Know the hazards that may be faced (e.g., possible LEL conditions) during entry, including information on the mode, signs or symptoms, and consequences that might occur due to lack of oxygen or exposure to toxic air contaminants.

b.) Ensure that the only hazard posed by the Confined Space is a potential for hazardous atmosphere* and that ventilation alone can be sufficient to maintain the space safe for entry.

c.) Test atmosphere prior to entry and record results. Continuously monitor the atmosphere during entry.

d.) Ensure barriers or other guards are in place around the space opening.

e.) Exit immediately from the space upon any atmospheric alarm.

f.) Adhere to the duty requirements of the Entry Supervisor.

Note: An employee shall meet the training requirements of an Entrant and Entry Supervisor to perform Non-Permit Entries.

4. Attendants Shall: (Permit space only)

a.) Be First Aid and CPR certified.

b.) May simultaneously serve as an entry supervisor.

c.) Know the hazards that may be faced (e.g., possible LEL conditions) during entry, including information on the mode, signs or symptoms, and consequences that might occur due to lack of oxygen or exposure to toxic air contaminants

d.) Remain outside the permit space during the full operation.

e.) Monitor activities inside and outside the space for safety.

f.) Maintain active communication with Entrant.

g.) Maintain a correct count of authorized Entrants, if there is more than one.

h.) Keep unauthorized persons from entering the space.

i.) Perform no duties that might interfere with Attendant's primary duty. (i.e. flagging and miscellaneous distractions)

j.) Order Entrant to evacuate if a dangerous situation develops.

k.) Perform non-entry rescue* only.

l.) Summon rescue and other emergency* services if Entrant needs assistance to escape in an emergency.

Note: Anchor has the authority to designate any employee (non-represented or represented) to be the Entry Supervisor, provided the training and certification requirements have been met.

5. Entry Supervisor Duties

a.) May simultaneously serve as and entry attendant.

b.) Have received *current* CSE training.

c.) Know the hazards that may be faced (e.g., possible LEL conditions) during entry, including information on the mode, signs or symptoms, and consequences that might occur due to lack of oxygen or exposure to toxic air contaminants.

d.) Evaluate Confined Space hazards and ensure controls are in place.

e.) Determine the responsibility for permit requirements, hazard controls and permit sign-off.

f.) Terminate the entry and cancel the permit.

g.) Verify that rescue procedures are in place and rescue services are available.

h.) Remove unauthorized individuals who enter or attempt to enter.

i.) Review Confined Space work in progress to ensure that acceptable entry conditions are maintained and workers are following the procedure.

VIII. PROCEDURES

A. PRE-ENTRY EVALUATION

The Entry Supervisor Shall:

1. Evaluate whether the Confined Space must be entered. Explore whether other controls/procedures could be used to prevent someone from entering the Confined Space. Explore every possible alternative to prevent the initial entry.

2. Conduct a visual survey of the Confined Space to identify any potential hazards (e.g., hazardous atmosphere, physical hazards, history and location of the space, etc).

Note: The Entry Supervisor must determine what safety equipment, including personal protective equipment is needed for the job, and ensure that the gas monitor has been calibrated, and fresh air checked.

3. If the Entry Supervisor is unclear whether a Confined Space is PRCS or non-permit, then the Pre-Entry Checklist (Attachment C) must be completed. The Entry Supervisor's determination is based on the identified hazards, and evaluation of those hazards eliminated and/or control measures to ensure safe entry. See Sections B & C for specific Non-Permit and Permit procedures.

Note: All Confined Spaces are to be considered Permit-Required until the Entry Supervisor has researched and verified the historical data to down-grade the PRCS to Non-Permit.

4. Review work to be done in the Confined Space to evaluate its potential to create a hazardous atmosphere or other hazard.

5. After the Confined Space determination has been made, the Entry Supervisor must ensure that the Entrant and Attendant are trained and certified to enter the Confined Space. When an entry supervisor and attendant duties are combined, he/she must ensure that that all entrants are trained and certified to enter the confined space.

B. PERMIT-REQUIRED SPACE PROCEDURE

Note: All Confined Spaces* are to be considered Permit-Required until the Entry Supervisor determines otherwise.

1. Pre-Entry. The Entry Supervisor shall conduct the pre-entry procedure and determine if the Confined Space is to be Permit-Required.

   a.) The Entry Supervisor shall ensure that the Attendant has current CPR/First Aid certification.

   b.) Entry Supervisors, Entrants and Attendants shall have received current CSE training.

2. Inspection. The Entry Supervisor* shall ensure that all safety equipment is visually inspected prior to each use or entry, and is in a "ready state." Equipment includes, but is not limited to:

    - Ladders (where applicable)
    - Tripods and winches
    - Safety Harness/Life Lines/Lanyards
    - Gas Monitors (calibrated, properly zeroed, field-checked and/or bump tested)
    - Communication Systems
    - Explosion-proof equipment if needed

3. External. The perimeter of the Confined Space shall be barricaded or roped off to prevent unauthorized personnel from entering the space. Additionally, if entrance covers are removed, the opening shall be promptly guarded by a railing or temporary cover, until work in the confined space resumes.

    Manholes may be guarded or blocked by the van or an Attendant. One person at all times is responsible for keeping people away.

4. Environmental Survey. The Entry Supervisor and other on-site personnel shall survey the surrounding work environment to ensure that:

    - all external controls are in place (traffic control, barricades);
    - all physical hazards have been eliminated or controlled;
    - the Confined Space opening is guarded by a railing or temporary barrier;
    - all isolating devices are in place (lockout, blanking lines, etc.); and
    - all ventilating equipment is operating.

5. Air Testing. Air test the Confined Space for oxygen, flammability (LEL), hydrogen sulfide (H2S), carbon monoxide (CO), and any other possible contaminants based on pre-entry survey. The test shall occur:

- prior to entry
- during entry/continuous
- prior to reentering the space after work is suspended for any reason

Note: Air contaminants might be introduced into the space during work activities, additional air testing for these air contaminants will be needed during entry.

Entry is prohibited until initial testing of the atmosphere is done from outside the space and determined to be safe. Under no circumstances shall entries occur if the meter detects (by alarming) a hazardous atmosphere, or if there is other information that indicates a hazardous atmosphere may exist.

If the pre-entry survey indicates the potential for flammable atmosphere, an initial test must be taken through the small holes in the manhole cover prior to removal. For manholes that are solid the testing will be done after cracking open the cover. Eliminate all ignition sources, and use only tools that will not emit sparks, such as power drills, to open the cover.

If the alarm sounds while working in the space, all Entrants must exit from the space immediately!

Training and certification in atmospheric testing for all Confined Spaced personnel must include the ability to correctly interpret gas monitor readings.

6. Personal. Personal protective equipment required for entry includes, but is not limited to:

- Hard hats
- Eye wear (glasses or goggles depending on the hazard)
- Gloves
- Protective clothing (coveralls, raingear, chemical suits)

Each Entrant or his authorized representative must be provided the opportunity to observe and obtain results of pre-entry monitoring or other testing of a PRCS. If a request is made by an employee to reevaluate the Confined Space, then the Entry Supervisor will comply with that request before proceeding with the entry.

7. Entry Permit.*The Entry Supervisor shall obtain an "Entry Permit" and complete each section prior to entry (See Attachment B). The following rules apply:

   a.) Permits shall be completed at the Confined Space location

   b.) Permits are only valid for the duration of work.

      1.) If Entrants exit from the space for short periods (breaks, lunches, etc.) a new permit does not have to be issued provided that the Entry Supervisor conducts atmospheric testing prior to re-entry, documents the readings on the permit, and double checks that all potential hazards are controlled.

   c.) The Entry Supervisor terminates permits when:

   - work is temporarily postponed,
   - work is completed, or
   - a hazardous condition develops during entry

   d.) All terminated permits shall be forwarded to the Anchor HSM.

   e.) Permits shall be kept for one year.

   f.) Permits shall be posted at the job site.

   g.) If duties are transferred to new personnel, the new entry supervisor/ attendant shall completely re-evaluate the hazard potential of the confined space.

8. Respiratory Protection. The Entry Supervisor shall consider potential inhalation exposures (ammonia, sewage mists/vapors etc.) prior to each entry and determine the need for respiratory protection. The supervisor shall also define the specific respirator protection for the entry. Half-face respirators equipped with organic vapor cartridges in conjunction with N 100 particulate filters will protect against low level organic solvents and particulate mists from sewage.

Note: Air contaminants might be introduced into the space during work activities. Additional air testing for these air contaminants will be needed during entry.

Under no circumstances shall entries be made with an SCBA or airline respirator with auxiliary escape bottle.

9. Fall Protection. The Entry Supervisor shall ensure that Entrant uses fall protection when working from any unguarded surface greater than 6 feet elevation. Under some circumstances, retrieval systems may be used for Fall Protection. All equipment used in confined spaces shall be consistent with manufacturer's specifications.

10. Communication. The Attendant must remain in continuous contact with the Entrant(s) and be prepared to retrieve the Entrant(s) whenever a prohibited condition occurs (i.e., Entrant exhibits behavior changes, gas monitor alarms, etc.). If visual contact can not be maintained, portable radios or some other reliable, pre-approved means must maintain effective communication.

11. Rescue. The Entry Supervisor shall ensure that rescue procedures are discussed with the Entrant and Attendant prior to each entry. At a minimum, the following rescue rules shall apply on all entries:

    a.) The entrant shall wear a full-body harness.

    b.) A mechanical lifting device shall be available at the job site to remove personnel from any vertical space more than 5 feet deep. When feasible the entrant will be attached by lifeline to a mechanical lifting device.

    Note: If a lifeline is <u>not</u> feasible, then prior arrangements need to be made with the Anchor HSM.

    c.) All rescue attempts shall occur from outside the Confined Space.

    d.) Under no circumstances shall the Attendant enter the Confined Space to perform a rescue.

    e.) The Attendant will have a two-way radio or cellular phone to notify dispatch or 911.

    f.) Outside rescue service (i.e. Portland Fire Bureau) shall assume full authority during the rescue procedure. The attendant shall remain at the entry point until relieved of this duty.

12. Ventilation. If any alarms occur, or the supervisor determines that a source of fresh air is needed, the ventilation shall be used to provide adequate levels of oxygen, to dilute toxic and flammable gases, and to improve general air quality. Ventilation equipment shall be explosion proof and be set at 100% outside air. To increase air circulation open additional manholes and other sources of fresh air on the upside/downside of the Confined Space.

    All "closed" Confined Spaces (vaults, wet/dry wells, manholes, etc.) may require the use of forced, mechanical ventilation, if fixed ventilation systems are not present. The Entrant will determine the need for ventilation. Natural

ventilation should be sufficient in all "open" Confined Spaces (clarifiers). However, if there is any doubt about the air quality, then mechanical ventilation shall be used.

If ventilation is needed:

- Introduce fresh air near the bottom of the immediate area where the Entrant will be present; and
- Position the fresh air intake in a clean air zone away from all combustion sources (i.e. vehicle exhaust).
- Retest Air

13. Electric. The Entry Supervisor must ensure that only double insulated electric tools or tools on a ground fault circuit interrupter system are used and all portable lights and tools are explosion proof where a potential flammable atmosphere exists.

14. Lockout. The Entry Supervisor and the Entrant shall ensure that all Potential Energy Sources have been adequately disconnected/ isolated from power source and locked out, and stored energy sources are controlled, prior to entry. This includes blocking lines and locking out valves.

15. Traffic. The Entry Supervisor shall ensure that employees working in roadways/walkways have the proper controls for traffic and access to manholes. All necessary barriers and traffic control devices shall be used. This includes ensuring that employees handling traffic are trained in flagging and traffic control.

16. Records. At completion of the entry, the Entrant shall retain the checklist and written certification of air testing for ultimate transfer to the project file.

C. NON-PERMIT SPACE PROCEDURE

A Non-Permit Space does not contain (with respect to atmospheric hazards), or have the potential to contain, any hazard capable of causing death or physical harm. The space has sufficient ventilation (forced or natural) to maintain a safe entry, all physical hazards (e.g., mechanical equipment) can be controlled from outside the space prior to entry, and there is no chance for engulfment.

Note: Work activities shall not introduce a hazardous atmosphere into the space.

1. Training. Entrant must be trained to the Entry Supervisor level to enter the Confined Space.

Note: Training and certification in atmospheric testing for all Confined Spaced personnel must include the ability to correctly interpret gas monitor readings.

2. Pre-Entry. If Entrant completes the Pre-Entry Checklist, the checklist must be posted outside the entry portal or another visible location at the entry site. The Pre-Entry Checklist cannot extend beyond the initial job purpose, or one shift, whichever is of the shortest duration

3. External Controls. The Entrant shall survey the surrounding work environment to ensure that all external controls are in place (traffic control, barricades) and that all physical hazards have been eliminated or controlled. The Entrant shall guard the Confined Space opening by a railing, or temporary barrier and will double check to ensure that all isolating devices are in place (lockout/tagout, blanking lines, etc). Industrial sampling manholes may be guarded or blocked by a van or an Attendant. One person at all times is responsible for keeping people away.

4. Inspection. Entrant shall inspect and ensure that all safety equipment is in good condition. If the job requires travel to a satellite work location, proper safety equipment must be in the vehicle. Use the Entry Permit as a checklist. (Attachment B)

5. Entrant. Non-Permit entries do not require an Attendant, therefore the Entrant must notify their manager/supervisor/lead person prior to entering a space and when the entry is complete.

6. Air TestingPrior to entry, the Entrant shall conduct atmospheric readings for oxygen, flammability, carbon monoxide and hydrogen sulfide, and any other possible contaminants based on pre-entry survey. If initial pre-planning identifies the potential for a flammable atmosphere (methane), then the under-side of the Confined Space cover shall be "sniffed" prior to opening. If all atmospheric tests indicate the atmosphere is safe then proceed with the entry.

Note: Gas Meter Chart - Appendix B

Note: Training and certification in atmospheric testing for all Confined Spaced personnel must include the ability to correctly interpret gas monitor readings.

Any employee who enters the space, or that employee's authorized representative, shall be provided an opportunity to observe the pre-entry testing. Test results must be documented by a written certification before entry takes place.

7. Continuous Monitoring. All entries must be monitored continuously. The gas monitor shall be attached to the Entrant during entry and if, at any time, the meter goes into alarm mode, the Entrant shall exit from the space immediately.

   The Non-Permit Confined Space will then be reclassified into a PRCS and no entry shall occur until the atmospheric hazard has been eliminated.

8. Ventilation. All "closed" Confined Spaces (vaults, wet/dry wells, manholes, etc.) may require the use of forced, mechanical ventilation, if fixed ventilation systems are not present. The Entrant will determine the need for ventilation. Natural ventilation should be sufficient in all "open" Confined Spaces (clarifiers). However, if there is any doubt about the air quality, then mechanical ventilation shall be used.

   If ventilation is needed:

   - Introduce fresh air near the bottom of the immediate area where the Entrant will be present; and
   - Position the fresh air intake in a clean air zone away from all combustion sources (i.e. vehicle exhaust).
   - Retest Air

9. Respiratory Protection. The Entrant should consider potential inhalation exposures (only at a nuisance level, e.g., sewage mists/vapors etc.) prior to each entry and may decide to use respiratory protection. The filtering respirators shall eliminate most odors and filter out particulate mists.

10. Electric. The Entrant must ensure that only double insulated electric tools or tools on a ground fault circuit interrupter system are used and all portable lights and tools are explosion proof where a potential flammable atmosphere exists

11. Records. At completion of the entry, the Entrant shall retain the checklist and written certification of air testing for ultimate transfer to the project file.

CONFINED SPACE ENTRY POLICY – January 2007

Revised By: _____ Date: _____

Dennis Hanzlick, Anchor Health and Safety Manager

Reviewed By: _____ Date: _____

David Templeton, Anchor Partner

Approved By: _____ Date: _____

David Templeton, Anchor Partner

Appendix A – Gas Meter Chart

	Oxygen	Methane	HydrogenSulfide	Carbon Monoxide
Meter Reading	% O_2	LEL CH_4	ppm H_2S	ppm CO
Safe Level	Normal = 20.9% Minimum = 19.5% Maximum = 23.5%	< 10% of LEL	< 10 ppm	< 35 ppm
Hazard/Health Effects	16% - fast breathing, drowsiness, nausea 12% - unconscious 6% - death	Explosive	50 ppm – eye irritation, headache, fatigue 100 ppm – deadens sense of smell in 3 min.; coughing, burning eyes & respiratory tract. 500 ppm – respiratory disturbances in 2-15 min.; strong irritation of eyes; dizziness, collapse 1000 ppm - immediate unconsciousness after 1 breath, death in 3-5 minutes	50 ppm – increases risk of heart attack esp. in people working hard 500-1000 ppm – Headache, rapid breathing, nausea, weakness, dizziness, mental confusion 4000 ppm - coma

Attachment A – Example of Multiple Copy Form – Do not Use

ANCHOR ENVIRONMENTAL, L.L.C.
CONFINED SPACE ENTRY AUTHORIZATION

Date:_____ Permit Duration: From _____ to _____ Project # _____

Project Manager: _____ Project Inspector: _____

Contractor Name: _____ Contractor Rep: _____

Space Location: _____

Brief Description of Work: _____

_____

_____

CHECKLIST OF SAFEGUARDS: *(Check those that are applicable.)*

POTENTIAL HAZARDS FOR THIS PROJECT

Biohazard	Engulfment	Industrial Area	*Other Hazards/Exposures*
Toxic (H_2S,CO)	Stored Energy	Falls	_____
Corrosive/Chemicals	Electrical Hazards	Noise	_____
Flammable (LEL)	Mechanical Hazards	Traffic	_____
Oxygen Levels	Structural Hazards	Hot Work	_____
Radioactive			

SAFETY PRECAUTIONS/PERSONAL SAFETY

Procedures	*Personal Safety Equip.*	*Energy Isolation*	*Fire Safety*
Bureau Procedure	Hard Hat	Tag and Lockout	Fire Hose Laid Out
Communication	Eye Protection	Lines/Valves Blocked	Extinguisher Available
Entry Coordination	Hearing Protection	Public Access	
Contractor Debrief	Foot Protection		*Other Precautions*
Permit Posted	Hand Protection		_____
Atmosphere Tests	Protective Clothing	*Electrical Safety*	_____
Ventilation	SCBA	Explosion Proof	_____
Traffic Control	Respirator	Sparkless Tools	_____
Pedestrian Safety	Tripod/Harness	Welding Protection	_____
Rescue Plan	Lighting	G.F.C.I.	_____

NOTE: There may be additional hazards associated with this confined space not covered by this checklist. This document is advisory only! The contractor shall be responsible for the safety of his/her employees and must comply with OR-OSHA 1910.146 Confined Space Entry Standards.

NOTES:_____

_____

_____

_____

Signatures: _____ _____

(Project Manager) (Contractor)

COPIES: White: Project Manager Yellow: Contractor Pink: Mike Reiner B310

Attachment B - Example of Multiple copy Form – Do not Use

ANCHOR ENVIRONMENTAL, L.L.C.
CONFINED SPACE ENTRY PERMIT

Entry Notifications:
☐ Operations ☐ Maintenance ☐ Contractor ☐ Other

Date:_____

Time:_____ am / pm

Description of Work Area and Work to be Performed _____

Work Group/Division _____

POTENTIAL HAZARDS FOR THIS ENTRY

☐ Biohazard	☐ Engulfment	☐ Industrial Area	*Other Hazards/Exposures*
☐ Toxic (H_2S,CO)	☐ Stored Energy	☐ Falls	☐ _____
☐ Corrosive/Chemicals	☐ Electrical Hazards	☐ Noise	☐ _____
☐ Flammable (LEL)	☐ Mechanical Hazards	☐ Traffic	☐ _____
☐ Radioactive	☐ Structural Hazards	☐ Hot Work	☐ _____

SAFETY PRECAUTIONS/PERSONAL SAFETY

Procedures	*Personal Safety Equip.*	*Energy Isolation*	*Fire Safety*
☐ Emergency Rescue Plan	☐ Hard Hat	☐ Tag and Lockout	☐ Fire Hose Laid Out
☐ Communication	☐ Eye Protection	☐ Blanking/Bleeding	☐ Extinguisher Available
☐ Entry Coordination	☐ Hearing Protection	☐ Disconnecting	
☐ Attendant	☐ Foot Protection	☐ Pumping	*Other Precautions*
☐ Permit Posted	☐ Hand Protection		☐ Traffic Control
☐ Atmosphere Tests	☐ Protective Clothing	*Electrical Safety*	☐ Public Access
☐ Ventilation	☐ Respirator	☐ Explosion Proof	☐ Barricades/Cones
☐ Traffic Control	Type:_____	☐ Sparkless Tools	☐ Opening Guarded
☐ Pedestrian Safety	☐ Fall Protection/Block	☐ Welding Protection	☐ Radio/Cellular Phone
☐ Training	☐ Tripod	☐ G.F.C.I.	available
☐ CPR/First Aid	☐ Harness/Lifeline		
☐ Hot Work			

CONFINED SPACE ATMOSPHERE ANALYSIS

METER #:_____ EXPIRATION DATE:_____ CHECK FOR ANY ALARM:_____

PARAMETER		TEST LOCATIONS				EXPOSURE		METER	ALARMS
		Sniff	Top	Middle	Bottom	Dose	Peak	Alarm Pts.	YES/NO
Oxygen	(%)	_____	_____	_____	_____	_____	_____	(+)or(-)19.5%_____	
Explosivity	(LEL)	_____	_____	_____	_____	_____	_____	(>)or(=)10%LEL_____	
Carbon Monoxide	(ppm)	_____	_____	_____	_____	_____	_____	(>)or(=)35ppm_____	
Hydrogen Sulfide	(ppm)	_____	_____	_____	_____	_____	_____	(>)or(=)10ppm_____	

ENTRY SUPERVISOR: (Print) Name/Title_____ Date_____

ENTRANTS: Name(s)_____

ATTENDANTS: Name(s)_____

ENTRY SUPERVISOR SIGNATURE:_____

EMERGENCY NOTIFICATION:

☐ Call 911 ☐ Division Mgr. Ph.#_____

☐ Safety/Loss Control Ph# 823-5509 ☐ Source Control Duty Officer Ph.# 823-7180

***COPIES**: **White**: Post at job site **Yellow**: Submit to Daily Lead **Pink**: Submit to Records/B310*

Attachment C

Pre-Entry Checklist

Date & Time of Entry: Location of Entry:

CHECKLIST	Y	N	N/A
1. Has the gas monitor been calibrated within the last 30 days?			
2. Did you fresh-air calibrate the monitor prior to conducting atmospheric tests?			
3. When monitored, was the atmosphere acceptable (no alarms given)? Please note levels. _____O_2 Level _____LEL Level _____H_2S Level _____CO Level			
4. Will the atmosphere be continuously monitored while space is occupied?			
5. Is there sufficient ventilation to keep the atmospheric conditions safe?			
6. Could the atmosphere change based on the nature of the work being conducted in the space (hot work, painting, coatings, etc.)?			
7. Are openings adequately guarded against accidental falls into the space?			
8. Are there barriers around the opening to prevent unauthorized entry?			
9. Have all energy sources been locked and tagged?			
10. Are pumps, valves, and lines disconnected, bled, or blocked?			
11. Have attendants/entrants/entry supervisor been trained and understand their duties/responsibilities?			
12. Is the appropriate safety equipment being used? (PPE, lighting, safety block, etc.)			
13. Have communication procedures been reviewed and understood by everyone?			
14. Have rescue procedures been reviewed and understood by everyone?			
15. Are adequate traffic control measures being taken?			
16. Is access/egress into the confined space **less** than 20 ft. in height?			
17. Has a review of the history for the confined space revealed a potential for sudden changes that could lead to sudden unexpected hazardous conditions?			
18. Can all the identified hazards be controlled?			

NOTE: If you checked any shaded area of the checklist, the space is automatically Permit-Required.

Non-Permit
Permit-Required

Print Name:_____

Signature: _____
(Entry Supervisor)

PERMIT-REQUIRED: Complete Entry Permit as outlined in Procedures.
NON-PERMIT: Post Checklist at Job site. If entering space without an attendant contact your supervisor prior to entry and inform them when you should be out of the space. When entry is complete, contact your supervisor and forward checklist to Admin, Front Office at B31

Note for construction activities: If an entry is made in an area where contract personnel or members of the public could impact the safety of entrants an attendant must be present.

Revised Aug 2000